

COURSE SYLLABUS

1. Program information

1.1. Institution	Petroleum - Gas University of Ploiesti
1.2. Faculty	Petroleum Refining and Petrochemistry
1.3. Department	Petroleum Processing Engineering and Environmental Protection
1.4. Field of study	Chemical Engineering
1.5. Study cycle	Master
1.6. Study program	Chemical Engineering for Refineries and Petrochemistry

2. Course information

2.1. Course title	Petrochemicals and fine chemicals synthesis		
2.2. Course coordinator	Lecturer Ph.D. Eng. Movileanu Daniela Luminița		
2.3. Laboratory / seminar coordinator	Lecturer Ph.D. Eng. Movileanu Daniela Luminița		
2.4. Project coordinator	-		
2.5. Year of study	I		
2.6. Semester *	2		
2.7. Evaluation type	E		
2.8. Course type - formative category **	DF	2.8. Type of subject matter ***	C

* the semester number is in accordance with the curriculum;

** fundamental = DF; domain = DD; speciality = DS; complementary = DC; thoroughgoing = DA; synthesis = DSI.

*** compulsory = C; optional = O; elective = E

3. Total estimated time (teaching hours per semester)

3.1. Number of hours per week	5	of which: 3.2. course	2	3.3. Seminars/laboratories	2	3.4. Project	-
3.5 Total hours from curriculum	56	of which: 3.6. course	28	3.7 Seminars/laboratories	28	3.8 Project	-
3.9 Time distribution							hours
Study of textbook, course support, bibliography and notes							34
Further reading in the library, on online platforms and fieldwork							15
Preparing seminars/laboratories, homework, portfolios and essays							15
Tutoring							2
Examinations							3
Other activities							0
3.10. Total hours of individual study		69					
3.11. Total hours per semester		125					
3.12. Number of credits		5					

3. Prerequisites (where applicable)

4.1. of curriculum	➤ graduated bachelor
4.2. of skills	➤ knowledge of organic chemistry, catalysis, mathematics, chemical reactors, use of computer technologies for data acquisition and processing and for documentation

4. Requirements (where applicable)

5.1. of course	➤ Course room with video projector
5.2. of seminars/laboratory	➤ Laboratory with micropilot plants

5. Specific competences

Professional competences	<p>PC1. Defining processes and design technical components: description, analysis and advanced use of fundamental concepts and theories in the field of chemical engineering</p> <p>PC2. Analysis of experimental data: determination of the physico-chemical characteristics, structure and properties of petroleum products and petrochemicals using complex analysis methods</p> <p>PC3. Design of equipment and apparatus for utilities: design of apparatus, processes and plants with the application of knowledge in the field of chemical engineering.</p> <p>PC4. Analysis of production processes in order to improve them: real time management of processes and plants in the chemical industry</p> <p>PC5. Development of design plans: conceptual design of chemical processes</p> <p>PC6. Knowledge, at high level, of specific software for chemical engineering and the use of computers and internet</p>
Cross curricular competences	<p>TC1. Efficient and effective performance of individual professional activities, under conditions of autonomy and professional independence</p> <p>TC2. Project management ensuring: Planning, organizing and leading of professional groups or institutions</p> <p>TC3. Capacity for permanent information and documentation in his field of activity, but also in related fields, both in romanian and in intenationally spoken language</p> <p>TC4. Ability to perform professional tasks as a team leader.</p>

6. Course objectives (based on the competence grid)

7.1. General objective	<ul style="list-style-type: none"> ➤ knowledge of processes for the production of the most important petrochemicals and fine chemicals and the impact of raw materials nature on the industrial technologies ➤ knowledge of the most important concepts of fine chemicals ➤ knowledge of main development tendencies in the petrochemistry and fine chemicals synthesis industry
7.2. Specific objectives	<ul style="list-style-type: none"> ➤ knowledge of the main raw materials for petrochemistry and fine chemicals synthesis ➤ knowledge, analysis and systematization of the basic principles in the field and of the technologies for industrial production of petrochemicals and fine chemicals ➤ knowledge of intermediates for the production of pigments, drugs, perfumes, cosmetics products, agrochemicals ➤ solving specific problems using gained knowledge ➤ acquiring new knowledge in the field, using modern information technologies ➤ understanding the current level of the petrochemicals industry and fine chemicals synthesis processes ➤ optimizing the conditions and methods of synthesis taking into account the profitability and environmental aspects of the processes ➤ development of new methods and technologies for the synthesis of petrochemicals and fine chemicals, considering the structural features and the properties of these compounds and the efficiency estimation of the developed methods and technologies ➤ rational choice of the best way to increase the efficiency of existing or new technologies

7. Contents

8.1. Course	Time	Teaching methods	Comments
Trends in petrochemistry. "Greening" the petrochemistry. History of development and complexity of fine chemicals industry	2	Lecture, questioning and debate	
Raw materials for petrochemistry and fine chemicals industry	3		
Technologies for production and use of synthesis gas	4		
Unit processes in petrochemistry	5		
Polymers and biopolymers	4		
Use CO ₂ in synthesis of petrochemicals	2		
Conventional and green technologies for production of fine chemicals in pharmaceutical, cosmetics and food industries	4		
Technologies for manufacture of: agrochemicals, dyes and pigments	3		
Progress in fine chemicals and speciality chemicals from biomass	1		
Bibliography			
1. Ullmann's Encyclopedia of Industrial Chemistry, 40 Volume Set, 7th Edition. Wiley-VCH, 2011			
2. Hutchings, G.J. (editor), Duncan Seddon, Petrochemical Economics. Technology selection in a carbon constrained world, Imperial College Press, 2010			
3. Hydrocarbon Processing. Petrochemical processes, 2010			
4. Chaudhuri, U.R., Fundamentals of Petroleum and Petrochemical Engineering, CRC Press, Boca Raton, London, New York, 2011			
5. Moulijn, J.A., Makkee, M., Van Diepen, A.E., Chemical process technology, 2nd edition, John Wiley and Sons, Chichester, UK, 2013			
6. Cybulski, A., Sharma, M.M., Moulijn, J.A., Sheldon, R.A., Fine chemicals manufacture: Technology and Engineering, Elsevier, 2001			
7. Pollak, P., Fine Chemicals. The industry and the business, 2nd ed., Wiley, 2023			
8. Sheldon, R.A., Arends, I., Hanefeld, U., Green chemistry and Catalysis, Wiley – VCH Verlag GmbH and Co. KGaA, Weinheim, Germany, 2007			
9. Ekinici, D. (editor), Medicinal chemistry and drug design, INTECHOPEN.COM, Rijeka, Croatia, 2012			
10. Verbeek, C.J.R., Products and applications of biopolymers, InTech, Rijeka, 2012			
11. Doble, M., Kruthiventi, Green chemistry and processes, Elsevier Inc., Amsterdam, 2007			
8.2. Seminar / laboratory	Time	Teaching methods	Comments
Hazard and safety in laboratory; types of reactors and auxiliary tools; physicochemical methods of analysis; writing/making laboratory reports	2	Conversation, explanation, questioning and debate	Compulsory
Synthesis gas by steam reforming of methane/methanol/ethanol. Chromatographic analysis of products	4		
Styrene by: 1. ethylbenzene dehydrogenation (with steam/with CO ₂).; 2. side –chain alkylation of toluene with methanol Chromatographic analysis of products	8		
Styrene/Methylmethacrylate polymerization – suspension and emulsion techniques	4		
Copolymerization of limonene with methyl methacrylate	4		
Furfural conversion into valuable chemicals	4		
Processing and interpretation of experimental results. Numerical applications. Evaluation of knowledge	2		
Bibliography			
1. Ullmann's Encyclopedia of Industrial Chemistry, 40 Volume Set, 7th Edition. Wiley-VCH, 2011			
2. Kirk-Othmer Encyclopedia of Chemical Technology Fourth Edition, John Wiley & Sons, 1998;			
3. Opris, I., Cigolea, V., Movileanu, D., Petrochimie – Caiet de lucrari practice, ed. a II-a, vol I, UPG, Ploiesti, 2001			
8.3. Project	Time	Teaching methods	Comments
Bibliography			

9. Correlation of the course contents with the demands of the epistemic community representatives, professional associations and representative employers in the field of the program

The course syllabus was developed in cooperation with representatives of engineering companies in Ploiești and Bucharest that have hired graduates of similar master programs.

10. Evaluation

Activity	10.1. Evaluation criteria	10.2. Evaluation methods	10.3. Percentage of final grade
10.4. Course	Theoretical knowledge, evaluated by questions on the subjects presented during the course	Oral assessment	70%
	Applicative knowledge, evaluated by solving problems/numerical applications		
10.5. Seminar / laboratory	General and detailed knowledge about processes studied in the laboratory	Evaluation of activity and laboratory reports	30%
	Applicative knowledge, evaluated by solving specific problems of the petrochemical processes and fine chemicals synthesis		
10.6 Project			
10.7. Minimum performance standard			
➤ For mark 5: solving 50% of the theoretical and applicative questions/items - for the exam			
➤ For mark 5: obtaining 50% of the points granted for general knowledge and demonstration of the minimum level in understanding and use of laboratory specific knowledge and activities – for the laboratory session			

Signature/date
05.02.2025

Course coordinator



Laboratory coordinator



Project coordinator

Date of approval in the
department

20.03.2025

Head of department
Assoc. prof. PhD. Eng.
Neagu Mihaela



Dean
Assist. prof. PhD. Eng. Dușescu-Vasile
Cristina

